

CUI



Draper: A short History and Vision for Our Westgate Operation

DRAPER PROPRIETARY

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CAGE Code: 51993

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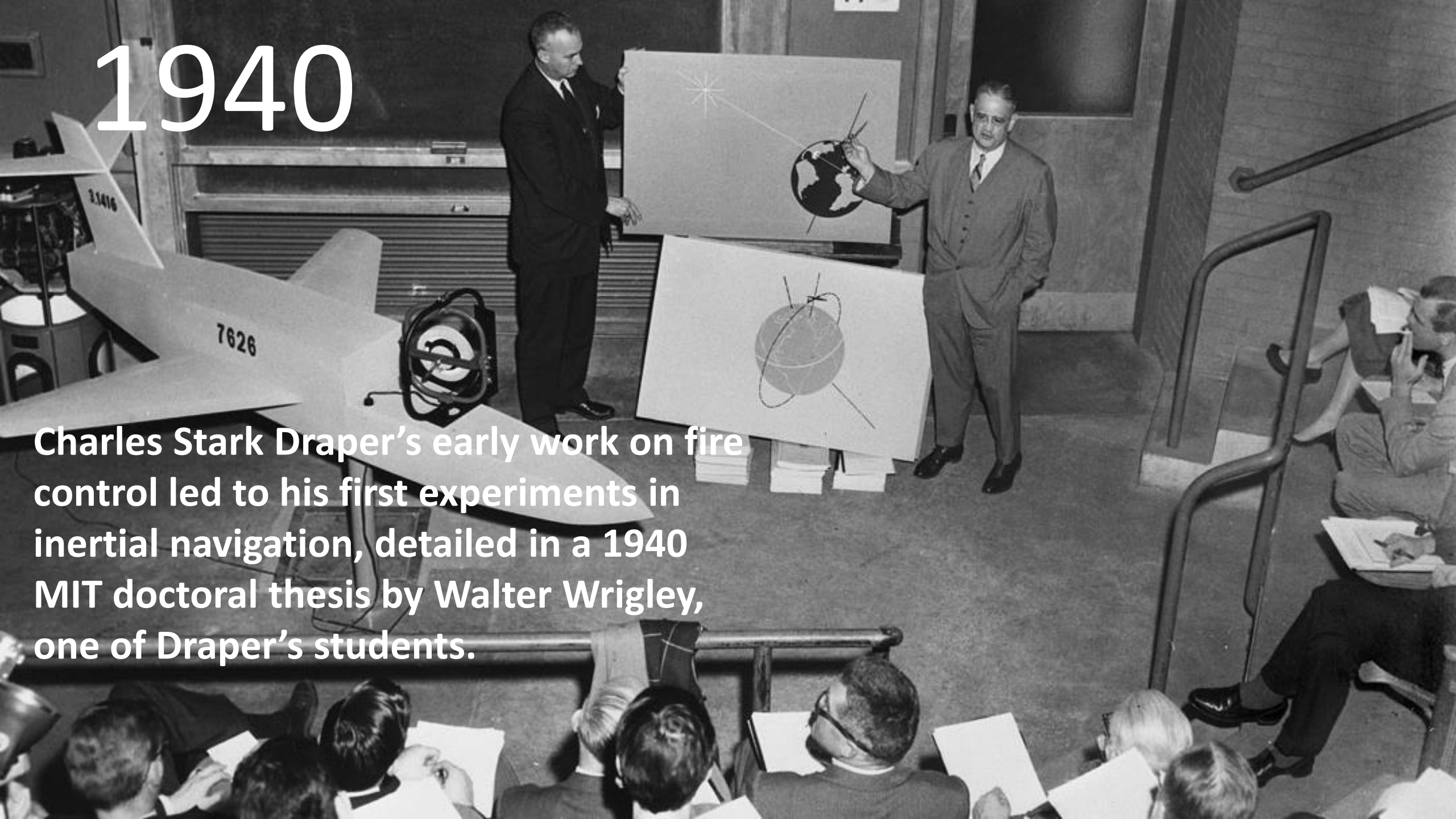
1933



Charles Stark Draper, Research Associate at MIT, led work at the Aeronautical Instrumentation Laboratory credited as notable contributions in the field in the MIT President's Report for 1933–34.

1940

Charles Stark Draper's early work on fire control led to his first experiments in inertial navigation, detailed in a 1940 MIT doctoral thesis by Walter Wrigley, one of Draper's students.



1947



The Instrumentation Laboratory developed the single-degree-of-freedom, rate integrating, floated gyroscope. It enabled a stabilized platform and led to the start of high-performance gyros for ballistic missile guidance, Apollo, SINS and satellites.

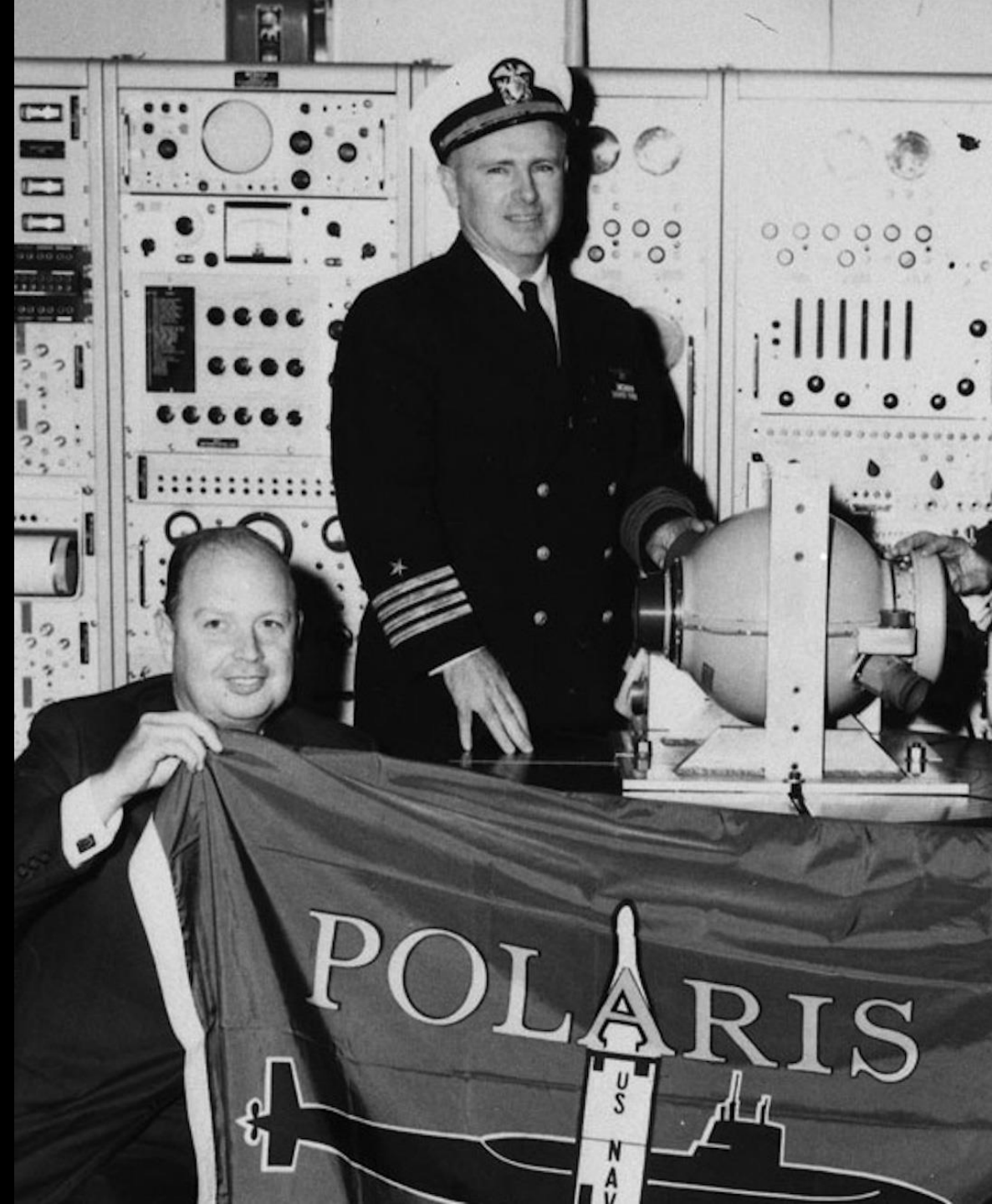
1957



The U.S. Navy issued a contract to design, model, test and document an **all-inertial guidance system for the Polaris missile**, beginning the long relationship between the Laboratory and the Navy Strategic Programs Office.

1960

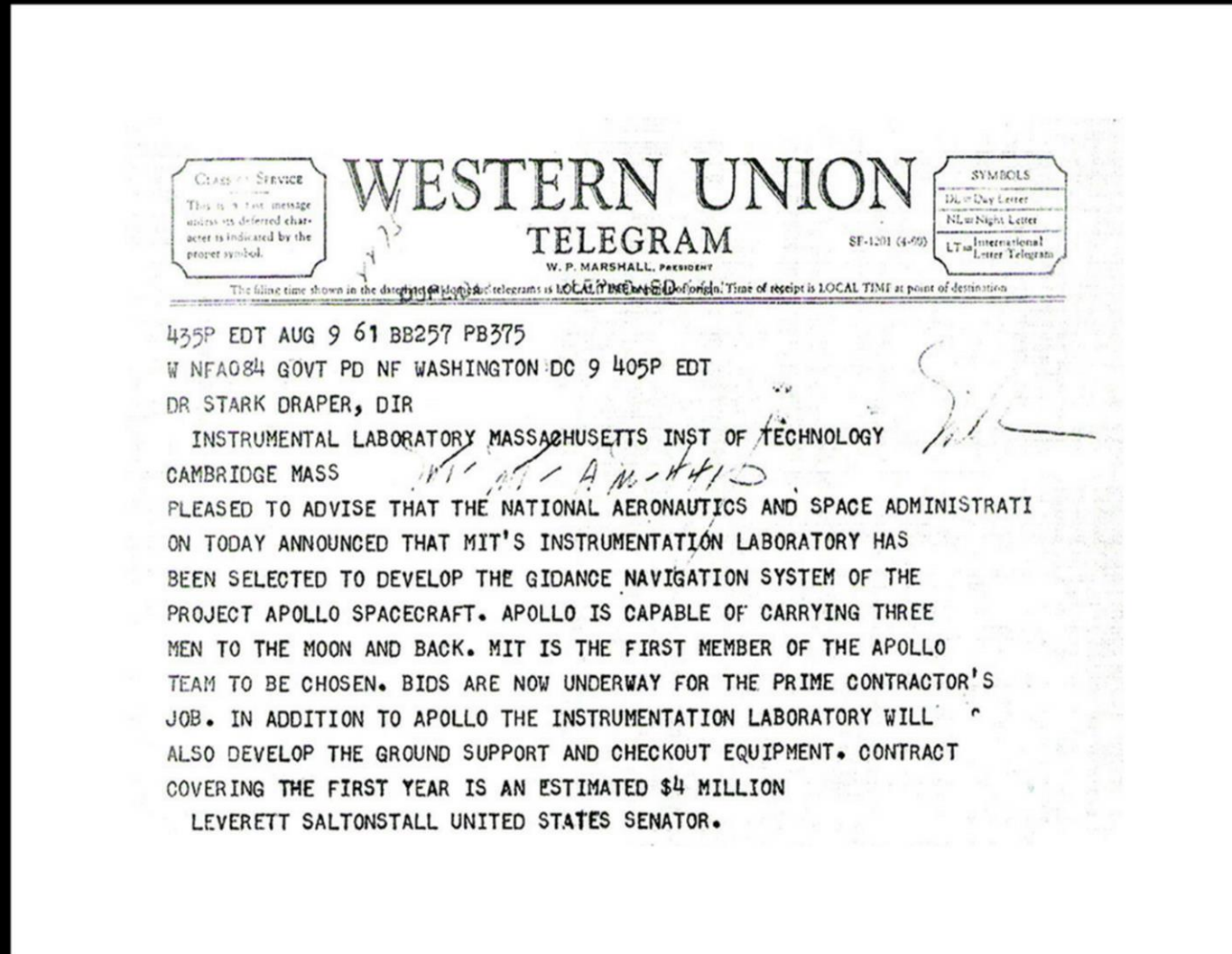
A **Polaris A1 missile** was launched successfully for the first time from a submerged submarine deployed with the MK1 guidance system designed by the Instrumentation Lab. The Polaris A1 had a range of 1,200 nautical miles.



1961

President John F. Kennedy commits the nation to put a man on the moon by the end of the decade. Draper received the first major contract awarded by NASA for the **Apollo project**, which was for the guidance, navigation and control system.

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1962

The **Polaris A2 Fleet Ballistic Missile** was deployed. Its guidance system, designed by the Instrumentation Laboratory, enabled the missile to reach a target 1,500 nautical miles away from launch point.



1963

The first flight of the **U.S. Air Force Minuteman II missile** with an NS-17 guidance system containing a Pendulous Integrating Gyroscope Accelerometer (PIGA) designed by the Instrumentation Laboratory occurs.

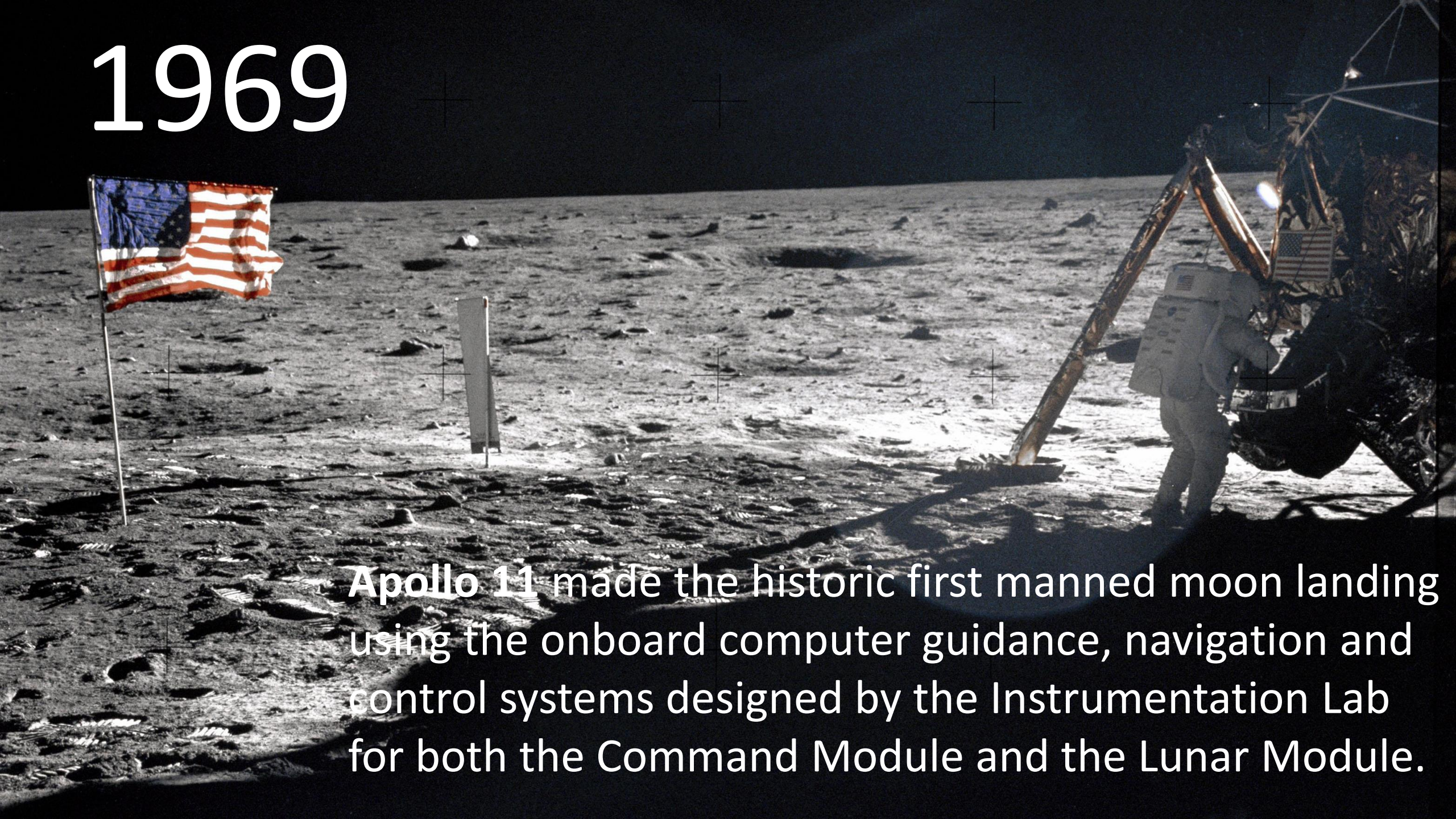


1968

The **Apollo 8** crew orbited the moon in a craft using a guidance and control system designed by the Laboratory.



1969



Apollo 11 made the historic first manned moon landing using the onboard computer guidance, navigation and control systems designed by the Instrumentation Lab for both the Command Module and the Lunar Module.

1970

Draper was asked to provide designs for the **Space Shuttle avionics system**; a contract was received in 1971 from NASA. Over time, Draper's role grew into sole responsibility for design of the Space Shuttle's on-orbit flight control system and its backup flight control software.

The **Apollo 13 crew was rescued** after an onboard explosion. Draper-developed contingency autopilot software in the Lunar Excursion Module (LEM) computer ensured stable control of the combined LEM and Command and Service Module during the trajectory correct maneuver to return to Earth.

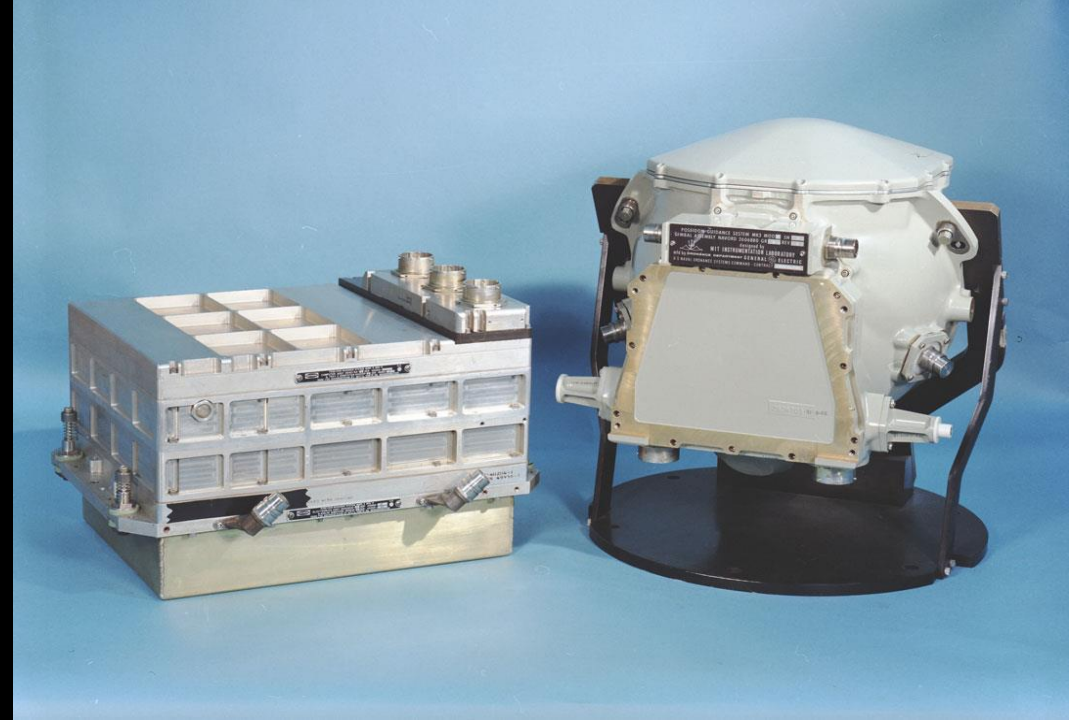


1971

The U.S. Navy **Poseidon C3 ballistic missile** using the Draper-designed MK3 guidance system was deployed on the USS James Madison.

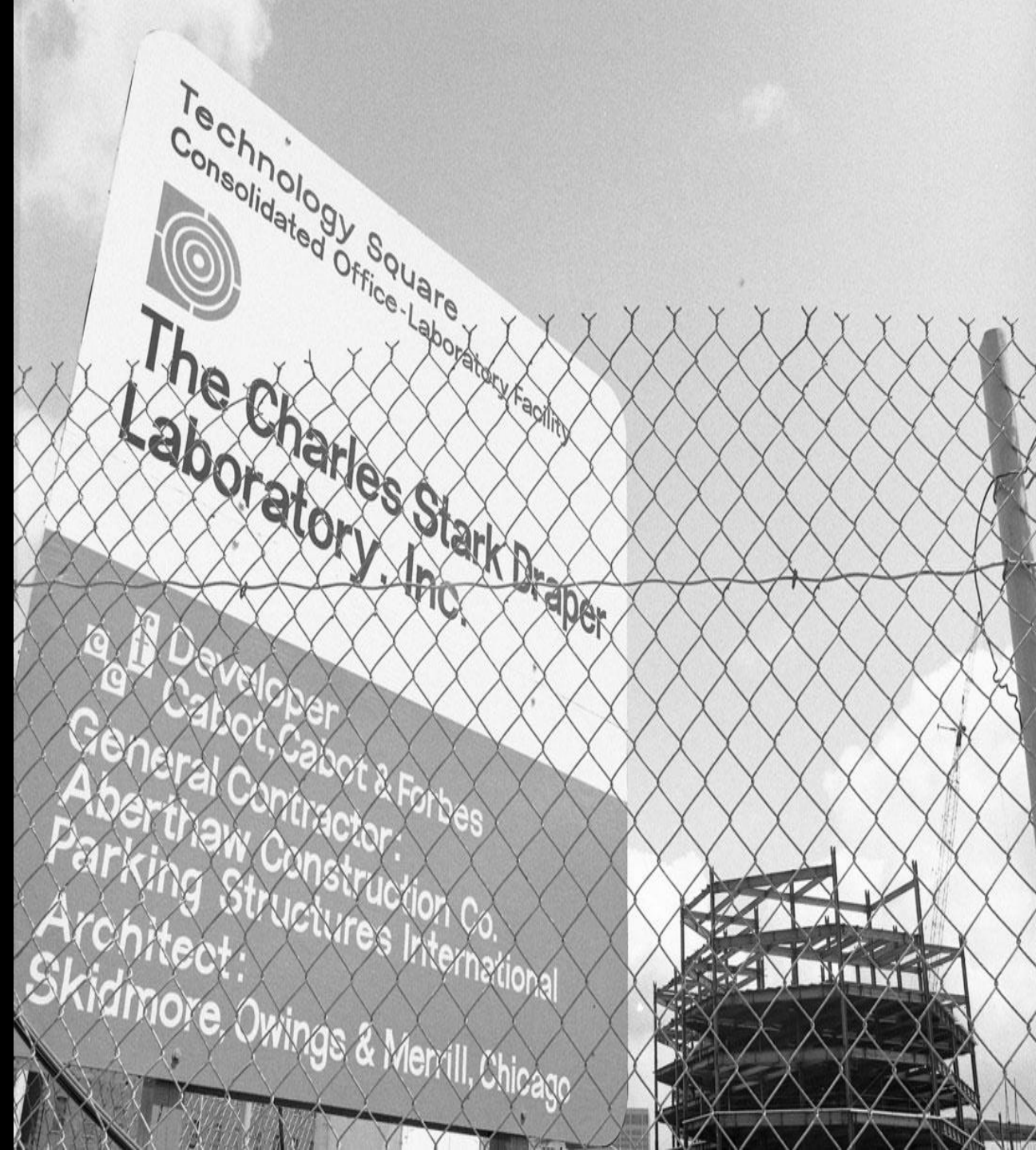
U.S. Navy's Special Projects Office (SP) gave Draper Lab overall design and development responsibility for the guidance system for the **Trident I missile**. The new design would use a star-tracker system to improve accuracy.

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1973

Draper became an independent, not-for-profit corporation, The Charles Stark Draper Laboratory, Inc.



1979

U.S. Navy Fleet Ballistic Missile Trident I (C4) containing the Draper-designed **MK5 guidance system** was deployed aboard submarines.

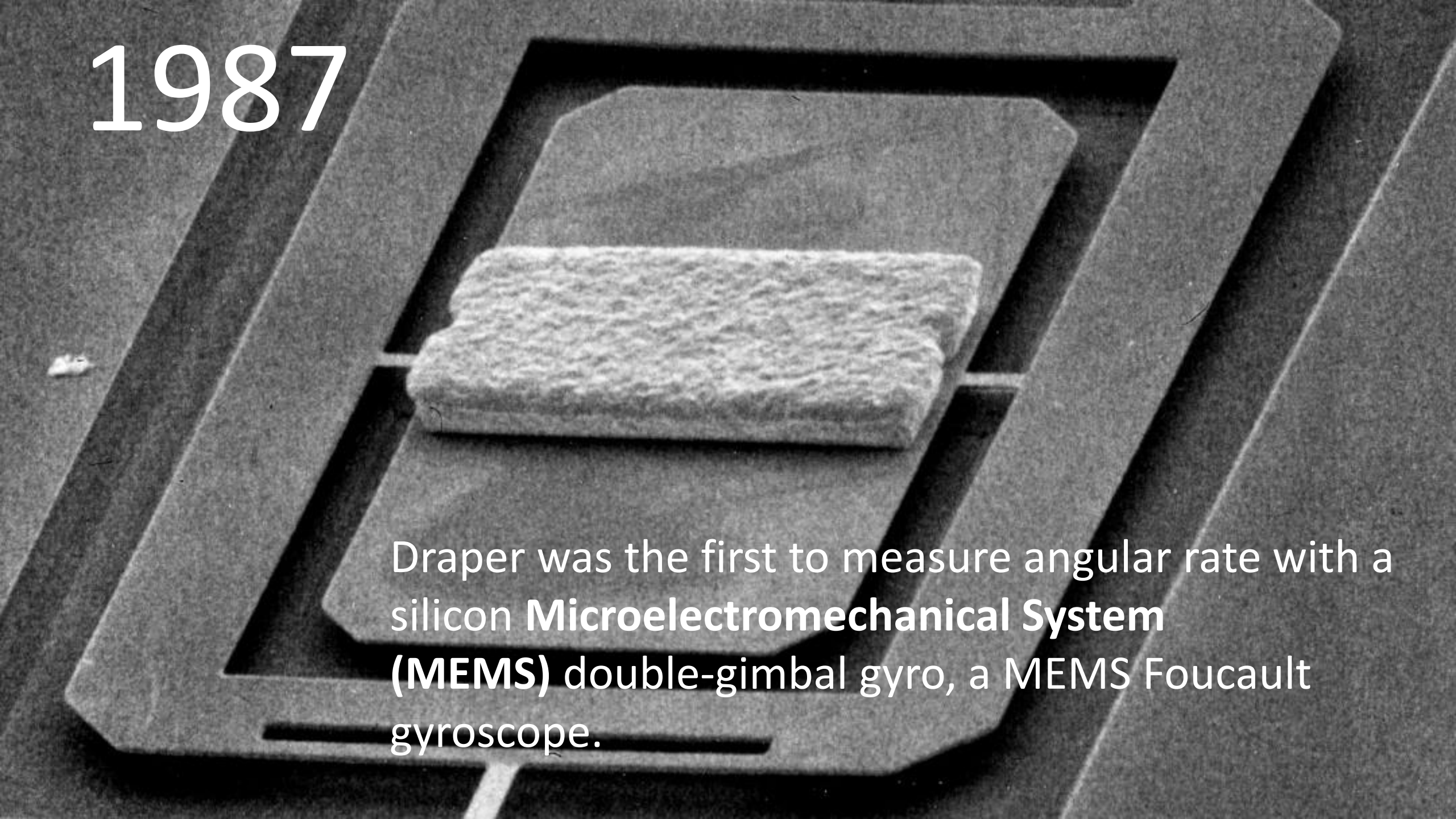


1981

The first launch of a **NASA Space Shuttle** occurred with a Draper-designed guidance, navigation and control system and backup flight system. Draper later upgraded the system for mission needs (e.g., Hubble Space Telescope Servicing Mission in 1993).



1987

A black and white photograph showing a silicon MEMS double-gimbal gyro, a MEMS Foucault gyroscope. The device is a small, rectangular, textured component mounted on a larger, dark, rectangular substrate. The substrate has a central rectangular cutout where the device is placed. The device itself has a rough, porous appearance, likely due to the manufacturing process. The overall image is in grayscale, emphasizing the textures and shapes of the components.

Draper was the first to measure angular rate with a silicon **Microelectromechanical System (MEMS)** double-gimbal gyro, a MEMS Foucault gyroscope.

1990

The U.S. Navy Trident II (D5) Fleet Ballistic Missile was deployed with the Draper-designed MK6 guidance system. The MK6 had been flight tested successfully aboard a Trident II missile in 1987.



The first of two Draper-designed **Unmanned Undersea Vehicles** began at-sea testing for DARPA. These autonomous testbeds were designed around Draper's fault-tolerant processor and vehicle control architecture and were used to test mission packages.

2016

Deployment began of the Draper-designed MARK 6 MOD 1 guidance system for the Trident II (D5) missile to the U.S. Navy submarine fleet: the upgrade replaced all the sensors and electronics and rearchitected the system.

Draper is prime contractor for design, development, production, and deployed system support for this guidance system.

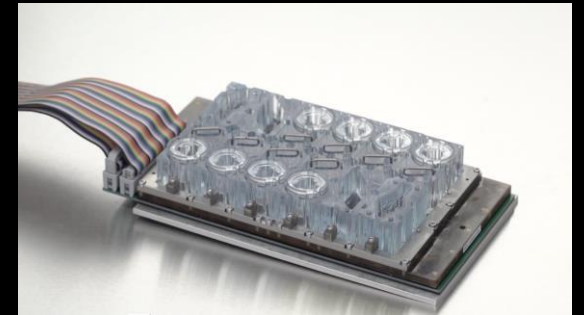


2017

During **DoD Conventional Prompt Strike (CPS) Flight Experiment-1**, a hypersonic glide body using Draper-designed avionics and flight software navigated precisely to target during its inaugural flight test. This demonstrates an accurate hypersonic long-range precision-strike capability for the first time.

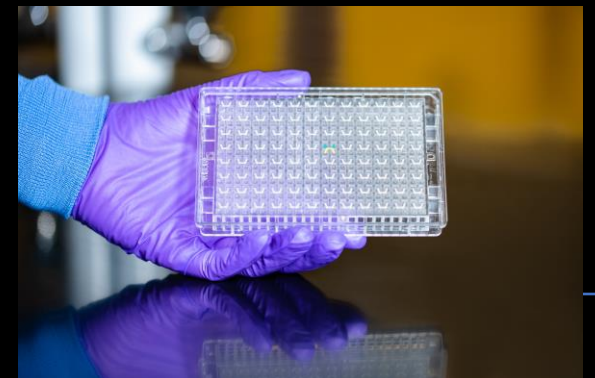
2019

Using **microphysiological systems technology** developed in collaboration by Draper and Pfizer Inc., the companies' joint teams developed vascular, liver and colon/ileum organ model systems over three years, to enhance preclinical drug safety and efficacy testing.



2021

Draper demonstrated the first SARS-CoV-2 infection and viral replication using a wildtype virus in a human tissue lung-on-a-chip. The experiments were conducted using Draper's **PREDICT96-ALI (airway-liquid interface) platform** and organ model.



Draper Today

Draper Statistics

Company Type:

- *Independent, nonprofit corporation*

Mission:

- *Applied research and development*
- *Technology transition*
- *Turning technologies into capabilities*
- *Advanced technical education*

Business areas:

- Strategic Systems
- Electronic System
- Space Systems
- Biotechnology Systems



FISCAL 2022

~\$660 M

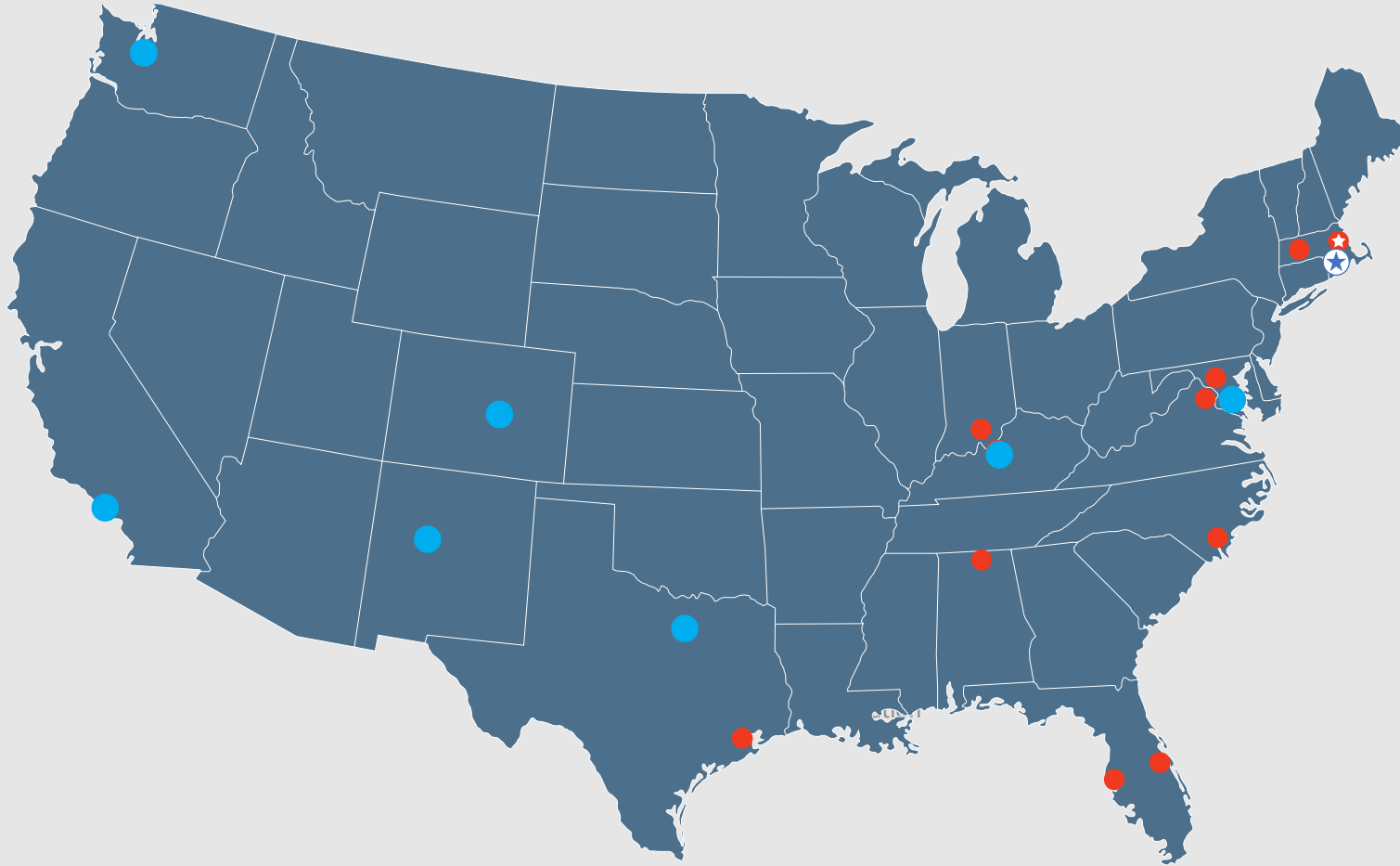
EMPLOYEES

1,900+

CAMPUSES

9

Our Campuses



- ★ **Cambridge, Massachusetts**
- **Cape Canaveral, Florida**
- **Houston, Texas**
- **Huntsville, Alabama**
- **Odon, Indiana**
- **Pittsfield, Massachusetts**
- **Reston, Virginia**
- **St. Petersburg, Florida**
- **Washington, D.C., Navy Yard**
- **Customer/Remote Locations**

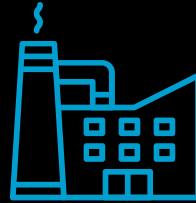
Working with Draper

As a nonprofit, Draper is able to center customers' missions in designing and developing systems solutions. We work with partners in:



GOVERNMENT

- Perform open-architecture design for use by government designees
- Executes low-rate production if needed



INDUSTRY

- Customization of technology for customer needs
- Technology transfer for volume production



ACADEMIA, NONPROFITS & FFRDCS

- Collaboration on our internal research and development and contract research and development work
- Joint proposals

WHY DRAPER at WESTGATE/ ODON:

Two Major Thrusts Coming Together At Westgate@Crane Tech Park

- Development/Test/Sustainment of Trident LE2 Microelectronics for Hostile Environment
 - Electronic Design
 - Packaging
 - Radiation Hardening
 - Cyber
 - Trust
- CHIPS Act Funding for DoD Microelectronics National Network for Microelectronics Hardware Prototyping, Lab-to-fab Transition Of Semiconductor Technologies,

Draper @ Westgate Has Major Role Working With Partner Companies, Universities And NSWC Crane
(Supporting Draper Strategic Systems and Electronics Systems lines of Business)

2019 Draper established the Westgate/Odon office to leverage relationships with key Indiana players: NSWC Crane, Purdue University, Indiana University and Notre Dame University and centered around three National Defense priorities:

Microelectronics

Nuclear Modernization

Hypersonic Systems

Current Staffing of 12 Engineers with expected growth in Strategic Systems and Electronics Systems Business lines

Focus: Systems Engineering/Test, Electronics Design/Test, Packaging & Rad Effects

THANK YOU!

Questions?